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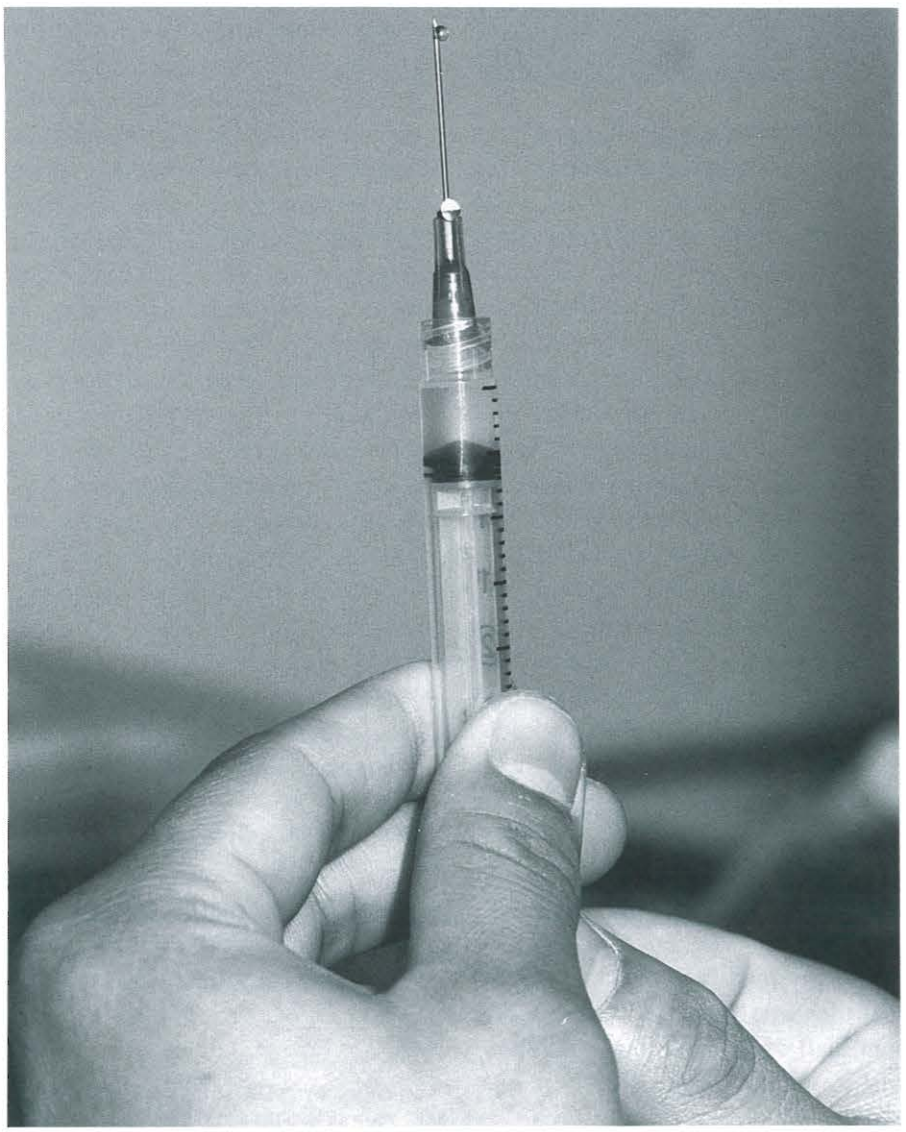
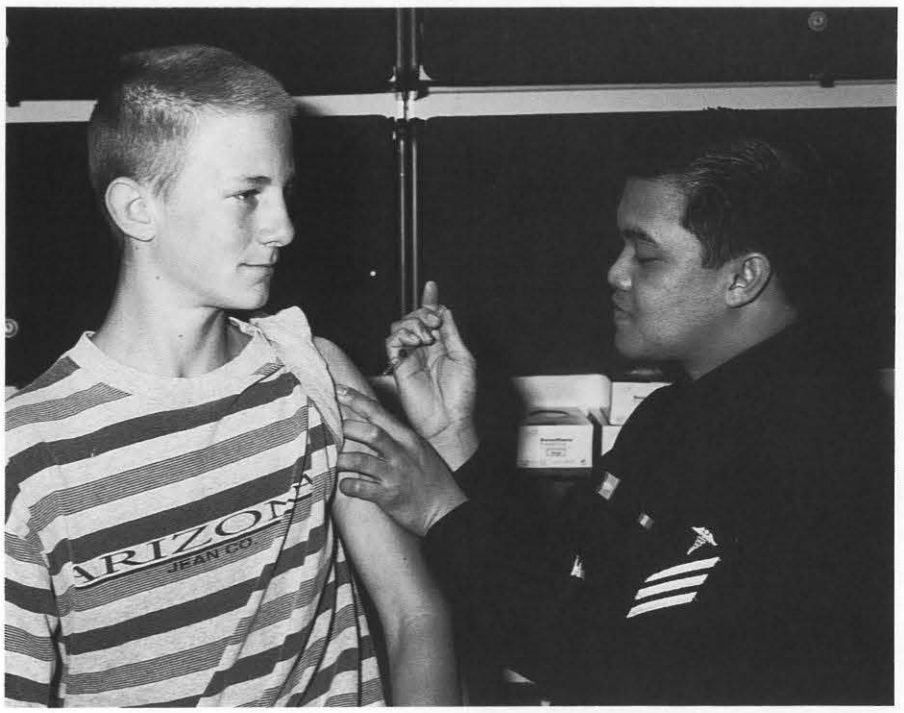
COVER: Astronaut CAPT Jerry Linenger, MC, dons his orlan space suit before beginning his 5-month stay aboard the *Mir* space station. Story on page 15. NASA photo.

Preventing Hepatitis B:

Immunization at the Adolescent Clinic, Naval Medical Center San Diego



Hepatitis B Virus (HBV) is a major cause of disease and death in the United States and throughout the world. Although acute HBV disease is severe or fulminant in only 1-2 percent of infected patients, from 5 to 10 percent become chronic carriers. The earlier in life one is infected the more likely one will become a chronic carrier. Of carriers, 25 percent develop chronic hepatitis, cirrhosis, or liver cancer. Among known human carcinogens, HBV is second only to tobacco, causing up to 80 percent of hepatocellular carcinoma (HCC), which is the third leading cause of cancer mortality in the world. Worldwide there are 200-300 million chronic HBV carriers, and close to a million die of HCC every year. In the United States these numbers are 1-1.5 million and 1,500 respectively, while another 5,000 Americans die each year from HBV-related cirrhosis. Furthermore, although treatment exists for those with chronic disease, at present it is only 40



percent effective and extremely expensive. At Naval Medical Center San Diego, CA, the cost of a 16-week course of alpha interferon for chronic hepatitis B is $3,700.

While these facts are sobering, HBV infection, disease, and death are preventable with a vaccine, and have been since 1981! It is also cost-effective. At the current cost of $6.91 a dose, 178 patients can receive a full series for every one patient who receives alpha interferon. Yet, HBV incidence has not changed significantly in the past 16 years.

According to the CDC's *Epidemiology and Prevention of Vaccine-Preventable Diseases,* 2nd edition (1995), two factors help to explain the apparent lack of impact from the vaccine. First, 25-30 percent of all HBV-infected patients, and as many as 60 percent of adolescents, deny any risk factors, making a targeted approach less than optimal. Second, the three major risk groups which have been targeted—heterosexuals with multiple partners or contact with infected persons, IV drug users, and homosexually active males—have not been reached effectively. As a result, universal immunization has been advocated. Since 1991, almost all newborns in the United States have been offered the vaccine, while the American Academy of Pediatrics (AAP), in its *1994 Red Book*, recommended that all adolescents be immunized whenever possible. In 1996, the Advisory Committee on Immunization Practices, in collaboration with AAP and the American Academy of Family Physicians, broadened its prior recommendations to include all adolescents at ages 11 and 12, though reserving its use in older adolescents to those at increased risk. The *1997 Red Book* calls for HBV immunization in *all* adolescents. By targeting adolescents, we do more than save lives and reduce the cost society must pay for their chronic disease. We take an even bigger step in reducing death and chronic liver disease in the next generation. Not only will many maternal chronic carriers pass the virus on to their children, but almost all infants with congenital HBV will eventually develop chronic disease.

Since 1993, the Adolescent Clinic at Naval Medical Center San Diego has been at the forefront of this effort. In 1996, we administered over 2,000 vaccine doses, with another 414 in the first 3 months of 1997. Actively promoting and screening for those who have not been infected or vaccinated (by both physician and nursing staff), striving to reduce barriers (no appointments or parental consent are necessary for hepatitis B vaccine), and attempting to increase compliance for patients returning for second and third vaccines (tracking, then phoning or sending postcards to remind them), the clinic has made HBV immunization a priority. We have also taken immunizations to schools where many of our eligible patients attend. As an example, supported in part by a grant from one of the distributors of the vaccine, over 50 high school students participated this year in an immunization drive at Junipero Serra High School, the site of one of our satellite school clinics. The schedule was arranged to enable students to complete the series during the course of the school year, while sacrificing minimal class time. On each of the 3 days, after receiving their "shots," the students enjoyed cookies and juice or milk and were entered in a drawing for prizes, including a mini-"boom box" and gift certificates for a local music and video store. The school principal drew the winners and also arranged for an article in the student newspaper to increase awareness among both military-eligible and nonmilitary-eligible students.

Hepatitis B is a major public health threat. The Adolescent Clinic at the Naval Medical Center is doing its part to lessen and hopefully eliminate this threat among our military families. ❑

—Story by CDR J. Christopher Daniel, MC. Photos by HM1 K.C. Baren.

Medical Support for Minefield Operations

The U.S. Naval Base at Guantanamo Bay, Cuba, protected by one of the largest active U.S. landmine fields, requires ongoing maintenance and grooming to ensure proper function. Because the mines degrade over time, they have been carefully placed allowing skilled personnel to locate and replace them when necessary. Approximately 30 engineers serve with the 400 Marines assigned to the Marine Barracks Ground Defense/Security Force at Guantanamo Bay, the second oldest Marine Barracks in the Corps. These engineers are senior personnel (E-5 and above), and their skill level has been mandated by the 13 Marine fatalities incurred during minefield maintenance since the mines were placed in 1962.

U.S. Naval Hospital Guantanamo Bay provides dedicated medical support. Six hospital corpsmen—all volunteers and 8404 FMF qualified—serve full-time in the minefield medical support division of the hospital's emergency room. While other hospital corpsmen wear whites, those corpsmen assigned to minefield medical support wear the green field uniform of the Marines they support.

Four ambulances and other special medical equipment, dedicated minefield medical communications, and SAR corpsmen, are also assigned to minefield medical support. The hospital corpsmen who accompany the Marines each day to the minefields become full members of the minefield maintenance team. The minefield maintenance Marines, using past lessons learned, have developed strict standard operating protocols.

Minefield medical support personnel carry a mine "victim" to safety.

Hospital corpsmen joining the minefield medical support division receive a detailed orientation program and training designed to make them experts in the complexities of the operation. That also means mastery of related equipment. The graduation exercise for those corpsmen includes recovery of a simulated patient from a minefield and transfer to the Naval Hospital's emergency room where care is passed to the hospital's staff surgeon and trauma team.

Minefield medical support demands surgical and trauma capability on the isolated base which is over 400 air miles from the nearest major trauma center in Miami, FL. In addition to minefield medical support, the hospital corpsmen maintain Marine medical records, and support Marine field operations including road marches and rifle/mortar shoots.

The Marines at Guantanamo Bay, particularly those assigned to minefield maintenance, have developed a special bond with the corpsmen assigned to minefield medical support. They proudly call those corpsmen their "docs." ❑

—Story by CAPT Bruce K. Bohnker, MC, executive officer at U.S. Naval Hospital, Guantanamo Bay, Cuba, and LT Paul D. Allen, MSC, public affairs officer at the same facility.

Last year President Bill Clinton ordered the destruction of thousands of U.S. landmines at the U.S. Naval Base, Guantanamo Bay, Cuba. Only landmines protecting U.S. forces in South Korea are being retained. The Marines are scheduled to complete the project by the end of 1999.

Hospital Disaster Preparedness:

Are You Ready for a Jumbo Jet Crash in Your Town?

LTJG Chris Hansen, MSC, USN

As the assigned Disaster Preparedness Officer at my command, I recently learned firsthand the importance of being prepared for a disaster. My primary job as the Plans, Operations, and Medical Intelligence Officer is to maintain the hospital at the cutting edge of military readiness, which means we should be ready to join other Pacific commands in support of a potential "major regional conflict" somewhere such as the Korean Peninsula, by receiving our share of wartime casualties. How much time should one spend on disaster preparedness? Typically, the only personnel casualties that take place here are due to auto accidents or drownings in our local treacherous waters. Our fine emergency room can handle these situations on their own, right?

U.S. Naval Hospital (USNH) Guam is a 55-bed hospital which serves the 7,500 active duty personnel on the island, along with approximately 20,000 dependent, retired, and VA beneficiaries, and is the only JCAHO accredited facility within thousands of miles. USNH Guam employs about 510 military and 130 civilian personnel. The island is also supported by Guam Memorial Hospital which serves Guam's general population (140,000 local residents). Twice each year, USNH Guam personnel participate in a command-wide mass casualty exercise to test our Mass Casualty Receiving and Treatment Plan. During these exercises it seems as though staff personnel go through the motions of a drill which will probably never happen in real life. Like it or not, we train and followup with documentation of performance improvement issues. In our most re-

Wreckage of Korean Airlines Flight 801

PH2(NAC) Rex B. Cordell, Fleet Imaging Center Pacific, Guam

cent exercise in April 1997, we participated in a joint island-wide exercise with local government agencies, simulating an *airline crash*, with a planned yield of about 15-20 moulaged casualties to be brought through our doors. No one would realize at the time how valuable this exercise would soon become.

Each time an exercise is performed, emphasis is placed on the weaknesses of the previous exercise. This time around, the decision was made to increase dramatically our stock of emergency/mass casualty equipment and supplies, and to store them in readily accessible locations. The project was initiated, but this is not a task that can be accomplished overnight. Mass casualty team captains worked with their teams' assigned supply petty officers to formulate mass casualty team supply cart item lists. These carts would be designed to be wheeled rapidly to their assigned treatment areas during a mass casualty. Additional readiness tools include our mass casualty team roster

Below: Rescuers carry one of the final survivors from the wreckage. *Right:* Litter team transfers patient from helicopter to a waiting ambulance.

PH3 Michael A. Meyers, Fleet Imaging Center Pacific, Guam

which is updated quarterly to keep up with personnel rotations. Rosters are posted in all spaces so personnel know what team they are supposed to muster with during a mass casualty.

KAL Flight 801 Crash

At 0142 on 6 Aug 1997, upon final approach to Guam International Airport, Korean Airlines (KAL) Flight 801, a Boeing 747-300 aircraft enroute from Seoul, Korea, crashed in mountainous terrain during a heavy rainstorm about 3 miles short of the runway. The aircraft skimmed the top of a ridge, then plummeted into a ravine where it slid briefly before impacting upon a buttress of land. The plane's fuselage broke apart in four sections, some of which burned extensively; the

AN Troy R. Weglietner, Fleet Imaging Center Pacific, Guam

tail and part of the midsection remained somewhat intact but the rest was unrecognizable. Of the 254 passengers and crew, most perished immediately upon impact. Some survived the crash, but died soon after from heat and smoke inhalation while trapped in the ensuing fire. A few were able to get away from the burning wreckage but died soon thereafter from burns/trauma/shock. Over 30 passengers/crew were found at the site still alive.

Emergency Response

The airport was unaware of the crash for 25 minutes, at which time rescue units began receiving notification. There was initial confusion concerning the plane's location and how to access the site. Emergency teams on duty were quick to respond; however, there was delayed supplemental emergency response at the scene due to the early hour. Initial responders included Guam Fire Department, Guam Police Department, and USNH Guam ambulance units, who arrived near the site within an hour of the crash. Several hours later, many other military units were on the mountain providing support where they could. These included the Navy Seabees, and Sailors from USS *Frank Cable*.

Timely evacuation of the survivors to either USNH Guam or Guam Memorial Hospital was hampered for many reasons. Physical obstacles, including a locked gate blocking an access road, a fuel pipeline broken by the plane's impact, and 200-300 yards of harsh, wet, jungle terrain, thick with 10-foot tall sword grass, delayed the arrival of rescue workers. To retrieve survivors and get them to a flat area for helicopter transport, rescuers had to carry them back across another 200 yards of a steep, muddy hillside in total darkness. Fires, explosions, and thick smoke limited rescuer access to the wreckage; there was no way to extinguish the fire.

For the first 1-2 hours following the arrival of rescuers, there were more survivors than emergency medicine personnel available to assist them. Despite these obstacles, USNH Guam emergency medical technicians (EMTs) performed heroically in their efforts to locate, triage, comfort, and transport survivors. Emerging 8 hours later from the jungle—worn-out, cut, bruised, dehydrated, and covered in mud—it was obvious these corpsmen had been "at war."

The crash site was located within 2 miles (straight-line) of the Naval Hospital, but over 7 miles by road. Navy CH-46 helicopters transported the survivors from the site after throwing caution to the wind and figuring out how to negotiate the rugged terrain at night.

The first survivors arrived at the triage site, situated adjacent to the emergency room, approximately 4 hours post-crash, and evacuation of other survivors continued for another 2 hours.

USNH Guam

Upon confirmation of the airline crash, the commanding officer of USNH Guam ordered the recall of all hospital personnel. The Mass Casualty Receiving and Treatment Plan was

PH3 Heather Gordon-Eghbali, COMNAVMARIANAS, Guam

Left: Members from local naval commands assist in litter-bearing at U.S. Naval Hospital Guam.Opposite page: From left to right—HM3 Paul Cihoski, LT Angela Boatman, LT Timothy Foster, and HM3 Stuart Dodd tend to a crash survivor in the emergency room.

thus activated at approximately 0300, whereby each staff member rushed to work and mustered on location with their assigned Mass Casualty Team. Some of our muster sites, such as the Delayed Care Team area, are set up in a contingency ward which is quickly rearranged in order to meet the needs of the impending patient load. Most of USNH Guam's 26 Mass Casualty Teams were mustered and ready to receive patients by 0405, approximately 1 hour after the initiation of the command recall.

It was dawn by the time the Helicopter Pad Team began off-loading patients from arriving helicopters, usually four per flight, transferring them from the pad to the triage site via ambulance. Upon receipt of patients, the triage officer directed the patients either to the emergency room, Delayed Care Team, or the Expectant Team. Emergency room personnel treated their patients and sent them either to the Expectant Team, Delayed Care Team, or the Pre-Operative Team. There were repeated requests for personnel from the Manpower Pool (personnel not assigned a specific team) in order to help with retrieval of supplies, transporting patients, or augmenting other Mass Casualty Teams in need. Andersen Air Force Base (36th Medical Group) health care providers augmented the Delayed Care Team. Military personnel from other commands, including a group of Navy Seals who had been on their way to the airport, helped search for survivors at the crash site. Korean language interpreters were also sent to the various team treatment centers.

Requests were made to CINCPACFLT Surgeon's Office for 12 additional surgical support personnel in anticipation of a heavy work load for the next few days. It then had to be determined where the USNH Guam's four severely burned patients should be medevaced for follow-on care. Eventually, it was agreed to send them to Brook Army Medical Center (BAMC). The BAMC Burn Team flew to Guam and provided care on the return flight. In addition, eight stable patients were sent back to Korea. These medevacs were coordinated to include the additional survivors at Guam Memorial Hospital. Eventually, a New Zealand native was medevaced back to his country. The remaining survivors were Guam residents who remained at USNH Guam until discharge.

Overall, USNH Guam received 19 survivors throughout the morning of 6 Aug. One was DOA, one was designated "expectant" and died at noon, and another died later that afternoon in the ICU, leaving 16 survivors. Guam Memorial Hospital provided care for 13 patients overall.

Aftermath

There is a minor footnote to this story. Curious and unexpected tasks a little beyond our normal realm of training and expertise were requested of us by the Commander, Naval forces Marianas (COMNAVMAR) in the weeks following the disaster. The radiology department, with the assistance of additional military radiology technicians from around the Pacific, was called upon to assist in the identification process at the forensic identification site (established at a pier-side warehouse at COMNAVMAR). Personnel X-rayed all human remains from the crash site. Members of the dental department also arrived there and helped identify remains through dental X-rays.

Working parties on daily shifts, comprised mostly of hospital corpsmen from USNH Guam and Pacific state-

PH3 Heather Gordon-Eghball, COMNAVMARIANAS, Guam

side naval hospitals, handled remains throughout other sections of the forensic identification site, including photography, pathology, forensic anthropology, personal effects, embalming, fingerprinting, etc. This process continued for 3 weeks. Another group of hospital corpsmen assumed full responsibility for the grisly task of removing all human remains from the plane wreckage. EMT personnel and a medical officer were assigned to provide medical care at the crash site in the event workers succumbed to heat illnesses or other injuries. Additionally, preventive medicine technicians were on site to prevent exposure to harmful, decomposed body fluids, jet fuel and hydraulic oils, as well as for proper handling and disposal of all biohazardous waste. Body extraction from the crash site took an additional 3 weeks.

Working parties at the crash site had to endure daily alternating bouts of gale force winds (from a nearby typhoon), rain, and high temperatures and humidity. Oftentimes, individuals were relieved from these work parties when observers noticed symptoms of emotional stress due to the unfamiliarity of working in an environment of *death*. Given that hospital corpsmen are generally accustomed to dealing with healthy, living patients, the handling of maggot-infested, rotting human remains was quite a challenge. Though the work was both mentally and physically harrowing, working parties maintained a diligent pace, their motivation coming perhaps from respect for grieving friends and relatives of the dead who awaited the bodies of their loved ones.

Throughout the 3 weeks, the Special Psychiatric Rapid Intervention Team (SPRINT), along with support from USNH Guam's mental health department, worked feverishly to ensure all personnel involved (from all commands) received "critical stress incident debriefing" upon completion of their disaster support efforts. No person was allowed to leave Guam without first receiving the debriefing.

Final Thoughts

Even though Guam seems at first glance a sleepy, recreational, retirement-type community, we all sense that things will happen out here, one way or another. Earthquakes are routine, a typhoon is liable to sack us at any time between April and December, and a war on the Korean peninsula would only be a 3-hour medevac flight from here. Add to that an occasional humanitarian effort such as Operation Pacific Haven (providing medical support to 7,500 Kurdish refugees), and participation in various Western Pacific exercises. In short, we are in harm's way, which motivates us to stay sharp.

Throughout the KAL Flight 801 ordeal, there were some important lessons learned which will hopefully help others to benefit from our experience.

Though some of the characteristics of this disaster were unique to our particular area, most of our lessons learned are universal. Always have your command organized into Mass Casualty Teams (updated at least quarterly), have an updated Pyramid Recall System (updated monthly), and have additional pre-staged emergency medical supplies ready to transport to the scene when needed. Then, get your personnel accustomed to these tools by incorporating them into your training.

In today's trend of military downsizing, it seems like we are all being asked to do the most with the least. For disaster preparedness, it can be tough to find the time and resources to build a good program if you don't believe anything bad will ever happen. Be creative; remedy equipment and supply deficits (litters, blankets, AMAL cans, etc.) by using the Naval Medical Logistics Command (NAVMEDLOGCOM) excess materiel bulletin or your local Defense Re-utilization Marketing Office (DRMO). To add icing to the cake, update your command's disaster plan by incorporating any expected joint participation from local civilian or military agencies. Add excitement to your exercises by performing jointly with them. Prioritizing between projects that will affect everyday hospital business and those that will only affect events that may never happen, can be tough. It helps to weigh the outcome of potential scenarios with both the probability and the possible magnitude of such scenarios.

It takes energy to get your command's disaster preparedness posture up to speed, but if you have the above-mentioned areas covered, and you exercise your disaster plan twice a year, you are already 90 percent there. The rest will come from the instinctive skills and expertise of your awesome Navy health care providers. So, when you get a phone call from the hospital quarterdeck at 0-dark-30 informing you of a plane crash or other mass casualty, it's probably not a drill. ❑

LTJG Hansen is Plans, Operations, and Medical Intelligence Officer at U.S. Naval Hospital Guam.

Super Typhoon Hammers Guam

No sooner had the author of this article sent off the final edit than super typhoon *Paka* hammered Guam. Many locals say this was the worst beating since 1976's *Pamela* and 1962's *Karen*. Reaching winds of up to 176 mph for hours at a time, *Paka* turned this lush, tropically vegetated island into a winter scene from Kentucky.

USNH Guam had nearly half its staff on board as in Condition of Readiness (COR) 1, for damage control purposes and receipt of potential casualties. Miraculously, there were very few storm-related injuries on Guam during the typhoon, because most commercial and residential structures are made with reinforced concrete. But the crew of USNH Guam certainly had their hands full in damage control efforts. The lab, main computer hub, radiology, and some of the clinics had to be shut down due to doors being blown out and ensuing water damage to equipment and supplies. The emergency room had to shift its location to the intensive care unit area for this same reason. However, within a few days of *Paka*'s passing, the hospital was fully operational with the exception of being on backup emergency generator power which reduces operating room capability and the availability of air conditioning.

Due to the destruction of Guam's power grid, electricity will not be fully restored across the island for 3 months. Many are still without water. So while USNH Guam has gotten back on track, the challenge will be to restore staff morale. Most of us are now getting used to more primitive lifestyles (oil lamps, hauling water from town, no A/C, no cooking over a stove, etc.), and shall be cleaning up well into the new year. The storm completely demolished the commanding officer's home. It had been a historic landmark built by Japanese prisoners of war for the American commanding officer after U.S. forces recaptured Guam from the Japanese during World War II. Most of the rest of us were fortunate and were left with structurally intact homes, with water damage only to low-lying personal property.

President Clinton has declared Guam a federal disaster area. Typhoon readiness? I'm now a believer.—LTJG Chris Hanson, MSC

Challenges of Spaceflight on Human Physiology

LTJG Joseph E. Ollivier, MSC, USNR

When the first American astronaut was preparing to venture into space his total time in orbit was calculated to be no more than 5 hours. Scientists estimated that an external foley catheter attached to a urine bag would adequately take care of any urine he might produce in space. By the end of his flight the astronaut had produced so much urine that it had filled the bag and was actually escaping into the capsule. Man had come face-to-face with one of the challenges he would confront in conquering space.

As that astronaut walked on the surface of the earth, human physiology adapted to the gravitational pull so that a certain volume of his body fluids were dependent in the lower portion of his body. When he entered weightlessness, fluids that were normally trapped in the lower extremities of his body were redistributed throughout his system (as much as 2 liters). His legs became thinner (known now as "chicken leg syndrome" to astronauts), his face became puffy, and face and neck veins became prominent.(*1*) His renal and vascular system sensed an increase in plasma volume and through physiological feedback mechanisms the body took steps to rid itself of the excess fluid, i.e., diuresis.

When the astronaut returned to earth a certain portion of his body fluid volume returned to his lower extremities, although his total body fluids had been depleted in space, so the net volume of fluid in his body was significantly less than when he left earth. The result was an individual suffering from artificially induced dehydration and secondary orthostatic hypotension, who probably could barely stand up in earth's gravity.

With the simple redistribution of blood flow due to weightlessness, the results became dramatic. Secondary effects of this fluid shift may also explain the more encompassing space sickness that two-thirds of the shuttle astronauts experience.(*1*) Space sickness can range from mild to severe in its presentation. These symptoms constitute nausea, vomiting, lethargy, malaise, depressed appetite, and gastrointestinal discomfort.(*2*) As the body grows accustomed to the weightlessness, symptoms will usually subside or disappear in several days.

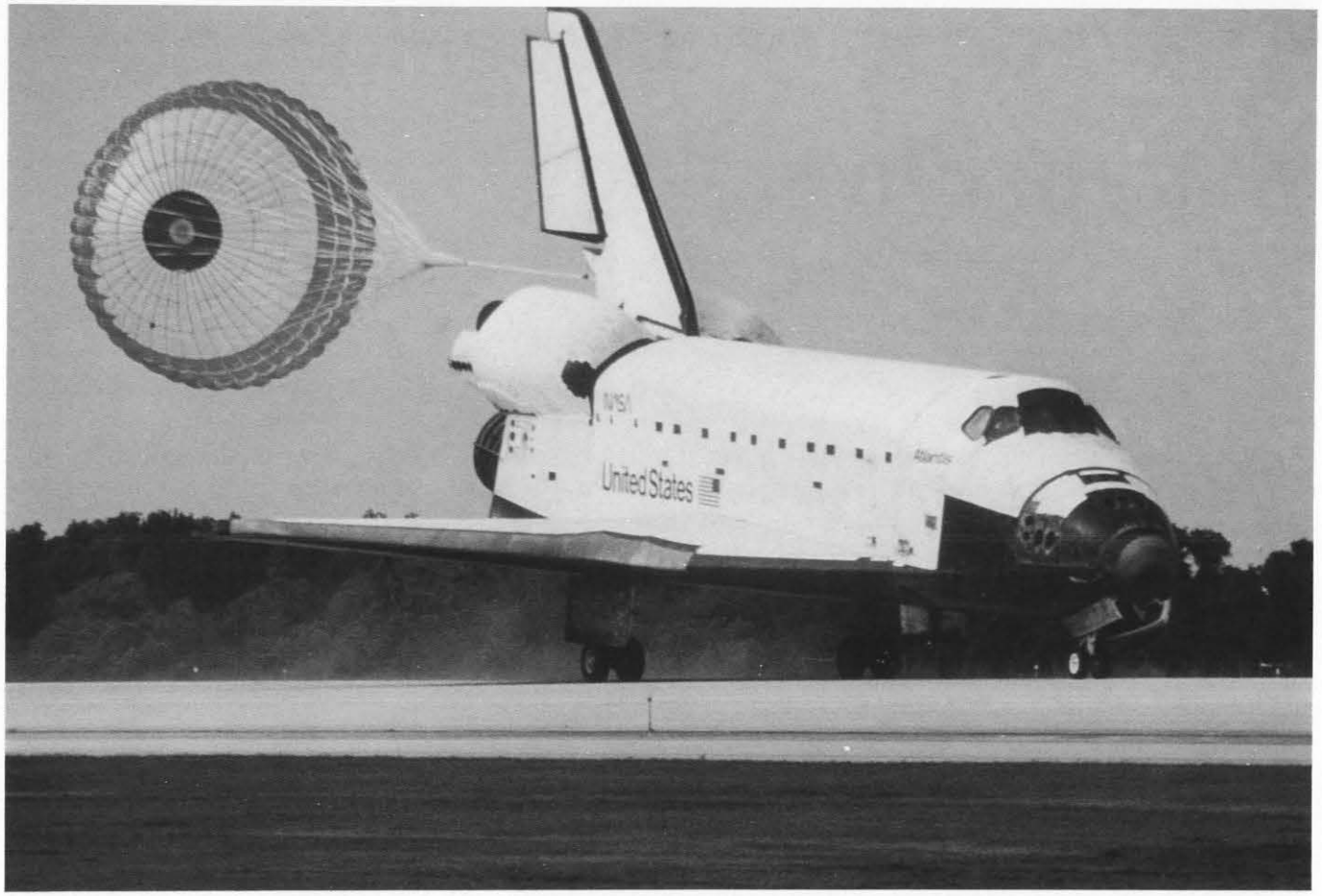
What else can we expect from manned spaceflight and prolonged weightlessness? We now know that the physiological adaptations of the human body to microgravity are extensive. Studies have shown that there is as much as a 22 percent decrease in the average plasma volume as compared to preflight volume. This causes an initial increase in the hemoglobin concentration, in other words an artificial polycythemia. To correct for this polycythemia the feedback mechanisms of the body decreases the regulatory hormones of the body such as erythropoietin, released from the kidney and atrial natriuretic factor (ANF), released from the heart.

Erythropoietin, a glycoprotein hormone, acts on the stem cells of the bone marrow to stimulate red blood cell (RBC) production.(*1*) The ANF, a hormone secreted by specialized cells in the cardiac atria, binds to specific receptors in the kidney and increases the urinary excretion of sodium. ANF secretion is thought to be affected by atrial distention, caused by increase volume, or in this case being decreased by sensing a reduced volume.

The reality of this weightlessness is that red blood cell production is decreased and sodium retention is increased. The impact on hematology goes even further. Altered hormone production and electrolyte loss more than likely affect cell differentiation and RBC survival.(*1*)

How will prolonged weightlessness affect human's immune system? Early studies indicated that white blood cells may fail to be activated by mitogen in weightlessness. Mitogen itself is a substance that induces mitosis (blast transformation); DNA, RNA, and protein synthesis; and proliferation of lymphocytes. How will this affect human's immune system on prolonged space missions?(*1*)

NASA photos

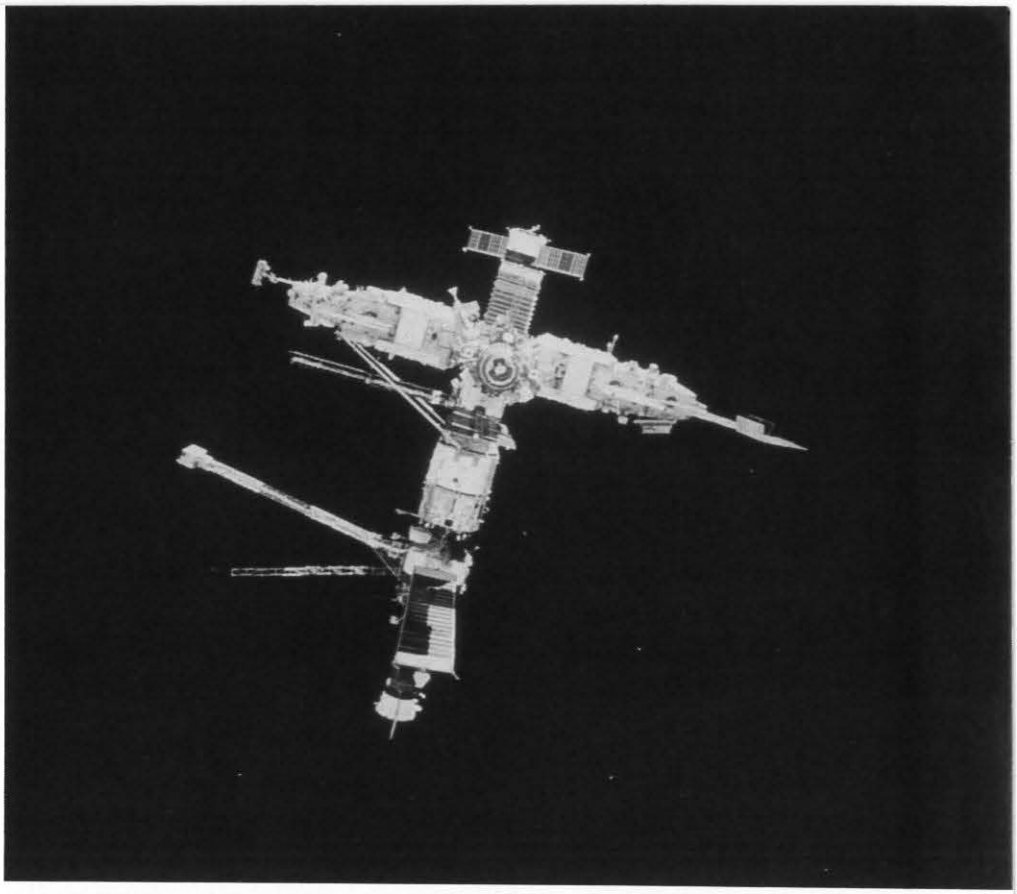


The musculoskeletal structure of humans is constantly being stressed against the gravitational pull of the earth. In orbit around the earth there is no stress. Calcium and weight-bearing bone loss is continuous and progressive in weightlessness. Blood serum calcium and cortisol levels are markedly increased in spaceflight, and we know that increased glucocorticoid levels are involved in osteoporosis through the decreased width of trabecular bone formation. There is some research that indicates osteoblasts have glucocorticoid receptors and that in the presence of glucocorticoid osteoblasts are inhibited from laying down new bone. Previous studies of bone mass after prolonged spaceflight clearly show there is progressive loss. In terms of muscle mass there is as much as a 25 percent decrease.(*1*) This loss is basically seen in protein and RNA structures, and not in cell number. Regular exercise inducing mechanical stress on bone and muscle tissue has been shown to reduce this loss. Whether it can compensate completely or whether there are pharmacological means combined with exercise to prevent this tissue loss is still in the investigational stage.

The most important muscle of the body, the heart, undergoes measurable deconditioning while in weightlessness. Studies of shuttle crewmembers have shown that microgravity decreases heart rate and arterial pressure; there is also evidence that spaceflight alters autonomic regulation of arterial pressure and that short duration spaceflight impairs human carotid baroreceptor—cardiac reflex response.(*3,4,5*) Through echocardiographic measurements it also appears that in spaceflight the end diastolic volume index falls along with the stroke volume index. Both are indicators of myocardium function.(*6*)

Will astronauts develop diabetes in space? Prolonged spaceflight is associated with loss of body protein and we know that insulin is an important factor in the regulation of muscle protein synthesis and breakdown. Researchers are interested in whether insulin resistance occurs in space and whether it is related to protein loss.(*7*)

Energy requirements of astronauts in microgravity was always thought to be less than on earth, but detailed studies done on Skylab have proven it to be incorrect. Findings have indicated that an increase in carbohydrate intake and continued loss of lean body



Left: **Shuttle *Atlantis* returns from a mission to resupply the *Mir* space station, *right.***

mass during spaceflight, looked at together, support the hypothesis that carbohydrate utilizations may increase during spaceflight.(*8*)

Discussion

We are now in our infancy of space physiology, but from our first venture into space it has been apparent that the human body undergoes systemic adaptation to stress and lack of normal exercise experienced in weightlessness. Previous observations of weightlessness on single cell animals such as prokaryote, eukaryote, and animal tissue show that basic cellular function is altered. Electrolyte concentration, cell growth rate, exocytosis, glucose utilization, bone formation, cortisol secretion, and response to growth stimulation are all altered in microgravity. Hopefully, with the implementation of Space Station Freedom through the international community, we will have a large permanent laboratory in orbit to continuously monitor, evaluate, and measure the effects of prolonged spaceflight on the human body. Up until the last several years, data from missions in excess of 3 months have been produced exclusively by the Russians. Those flights and current ones have demonstrated that important physiologic dysfunction will occur and that some countermeasures are partially effective in reducing certain changes.

As humankind prepares for a more extensive presence in space, the next logical step in our exploration is a permanent platform in space. From a research aspect this will be an opportunity to conduct human, animal, and plant studies. The duration of studies can be extended proportionately with crew rotation. And our knowledge will be significantly expanded.

Will humans be able to live in space for long periods? The answer to that question has already been answered from humankind's history. From the extreme colds of the polar caps, to the depths of the oceans, man has adapted. When man first ventured out on long ocean voyages, he was afflicted with a mysterious disease that caused malaise, weakness, swollen and aching joints, bleeding gums, loss of teeth, and eventually death. In 1747, James Lind, a young surgeon in Britain's Royal Navy, studied the problem, and with clinical experiments came up with a cure. He found the treatment for scurvy, the dreaded killer of seamen, to be citrus fruit. Most likely, humankind will also find the solutions to whatever challenges prolonged spaceflight brings.

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NASA photos

Opposite page: **View of *Atlantis'* forward section through a *Mir* window. *Left:* Seven astronauts and two Russian cosmonauts take a break from supply-transfer duties on *Atlantis'* mid deck. Left to right at bottom are: Peter (Jeff) Wisoff, John Blaha, Marsha Ivins, and Aleksandr Kaleri. Top left are: Brent Jett, Jr., John Grunsfeld, Jerry Linenger, Michael Baker, and Valeri Korzun.**

Mission to *Mir*

On 15 Jan 1997, astronaut CAPT Jerry Linenger, MC, joined the crew of Mir (Navy Medicine, *January-February 1997). Replacing John Blaha, Linenger became the fourth U.S. crewmember on the Russian space station. During his 5-month stay, the Navy flight surgeon's second space mission, he added to the knowledge base considered essential for the upcoming construction of the international space station.*

His visit was anything but routine. The 11-year-old Mir *was showing its age. Frequent breakdowns in the station's systems fueled a controversy as to whether the United States should continue to participate in the joint space venture. Balky oxygen generators required frequent maintenance, an obsolescent computer malfunctioned, and a dangerous fire nearly proved fatal to the crew.*

Nevertheless, Linenger performed many useful experiments and, as Mir*'s resident physician, monitored his own as well as the health of the cosmonauts.*

Navy Medicine *recently interviewed Linenger at the Johnson Space Center.*

Why were you selected for a *Mir* mission?

When I finished my last mission, the Chief of the Astronaut Office called me in and said, "Jerry. Great mission. You did a nice job. We're all proud of you." He then asked me if I was still interested in a long duration mission and told me I was their choice if I still wanted to do that. I told him I was interested but I wanted to talk it over with my wife and find out if she wanted to go to Russia for a year and a half if I accepted a 4- or 5-month mission to a space station. She was ready to travel a bit and it sounded good so I accepted a prime spot on one of the upcoming flights. I took a week's vacation and headed for Monterey to the Defense Language Institute for about a month and a half. Then we went right over to Russia.

How did the language studies go?

I had instructors in Russian language from one of the universities in Moscow. They came out to Star City, where we trained. I took Russian language in the morning and in the afternoon I'd learn the different systems—

space systems, life support systems, and all the complicated space material. It was definitely feet first. You're struggling with the language and at the same time you're getting all your systems training. The last few months, you finally reach critical mass in both Russian language and systems and that's when you really cram. All of a sudden you can ask the right questions because you've got the language capability. It took about a year and a half before I felt comfortable with the language and really knew the systems well enough to go on the mission.

And you used only Russian on the mission.

A hundred percent Russian on the station. The cosmonauts could help me out with a word or two. For example, if I didn't know the word for telephone, I'd say it in English very slowly and sometimes they could help me out. Among the crew, communication was very good and they probably picked up many of my grammatical errors and learned to live with them. Communicating was the key, not my grammar.

What's Star City all about?

It's an old KGB closed base—top secret—about 45 minutes from Moscow. It wasn't on the map back in the Cold War days. It's still a gated city and it's very much the way you picture communal living. It has its own gym, its own dining hall. People live and work there. There's no off-base living. It's a little community along the lines of the old communist model, and totally insulated from the rest of the country. But it's also very beautiful. Star City was built in an old northern woods with a lot of birch trees and paths going through the woods. Almost everyone there has a Dacha—a little cabin on a plot of land where they grow potatoes and vegetables during the summer.

What was a typical day of training?

A typical day included a few hours of Russian language, a few hours of studying life support systems, and in the afternoon, working simulators. Occasionally, we took a bus ride to an off-base facility. We might go inside a vacuum chamber, for example, or go into Moscow to be fitted for your spacesuit. And then I studied at night, trying to learn the language and the systems. They were very full, busy days.

Is their training different from ours?

It's very different. There's very little interchange and very few modern learning tools like computers. The training is definitely noncomputer-based learning. The job of trainers here is to impart the information and then you go back and forth with discussion. It's much more give and take. In Russia, the teacher is simply a lecturer. The actual teaching uses standard texts, much like we were schooled 30 years ago. For example, to test you, they bring in a board of 10 or 12 experts from the companies that build the space ship and they grill you with questions. It's an oral board.

Was the flight on the shuttle up to *Mir* similar to your previous flight?

It was in the beginning, but your perspective changes. After Russia, I came back to Houston for shuttle refresher training and that was barely a drop in the bucket as to what the flight would be. Shuttle time was 5 or 6 days and *Mir* time was 132 days. The main purpose of the shuttle was just to get me up to the place where I was trained to do my job. I was really the payload—the satellite.

How was the rendezvous and docking with *Mir*?

Impressive. The space shuttle *Atlantis* is coming up at 18,000 miles per hour docking with tolerances of just inches. You have to be within 2 inches for the docking ring alignment. You need to be within 0.1 foot per second of the speed you want closing between the two vehicles. Even though it's a huge spacecraft, the shuttle goes up there rock steady and just kisses the space station *Mir*. You can't help but be overwhelmingly impressed with the way the shuttle can perform that mission. After the docking, they open the hatch and it's like going to sea and you're trying to get all your supplies on board.

How did you feel when you realized you would be leaving your colleagues behind for a long time?

Well, you've got a lot ahead of you and so I wasn't looking behind; I was looking ahead and trying to do a good changeover with the American who was up there—John Blaha. It was like a handover in the Navy when you take over someone's job. You're really not thinking of what you did previously, but rather what's down the road. Emotionally, it probably peaked when I looked out the window after they departed. I took a deep breath and said, "Well, I'm up here now and committed, and I'm going to be here for the next 5 months and that's all there is to it. There goes my ride heading home and I'm not on it." You feel a sense of closure but by the next morning you're ready to get going because there's a lot to do.

What were some of those first projects?

A lot of it was activating the different science experiments, some of which would run the entire time I was up there. One of the first was getting the dosimeters operating so we could get a total time course of radiation dosage.

On the eve of undocking day, Jerry Linenger, Valeri Korzun, Aleksandr Kaleri, and John Blaha play with new flashlights brought up to *Mir* by the shuttle crew.

Air sampling was another. Surface sampling would give us a look at the initial flora and see how that changed over time. So I was very busy, especially with the experiments that would continue throughout the entire 5 months.

Were these continuations of experiments that John Blaha had started?

Some were continuations but for the most part, it was a brand new science program. There was a definite break in the science between John's flight and mine. My science program was much more linked to the person who followed me—Mike Foale. Ninety percent of the experiments were new. John packed up his gear and returned it and I unpacked new experiments.

How about the medical experiments?

Sleep study was an interesting one. You can imagine you're going around the planet every 90 minutes so every 45 minutes you have either sunrise or sunset. Circadian rhythms are messed up, to say the least. I would sleep with eyelid sensors on to look at my rapid eye movement sleep versus my deep sleep. And I would sleep a couple of nights a week with electrodes over my entire head looking at brain wave patterns of sleep. I would do about five mood surveys during the day looking at body temperature, very similar to the work we were doing out at the Naval Health Research Center in the sleep deprivation studies.

Were you doing this on just yourself or also on your colleagues?

I learned to do this on myself and I also learned to draw my own blood and be self-sufficient. If I needed help I always had everything totally prepared and then I would ask one of the cosmonauts to do something for me. I always tried to respect that they had projects and they also respected my time. Of course, with a lot of the system breakdowns, I would have to work the science in around repairing oxygen

generators and things vital for survival. We had to work together on those systems and we'd divvy up the work. But throughout the mission, I would always try my best to carry out the science programs and meet all the objectives.

Were the cosmonauts ever subjects for your medical experiments?

They also did some of the sleep studies and I would help rig them up. Usually, with most of those experiments, Americans were the principal investigators from different universities around the country. And I was the prime person to ensure they were carried on properly.

I'm sure they felt pretty good having a doc aboard.

It was very reassuring to them, especially with our share of problems. For example, we had problems with ethylene glycol vapors leaking, and temperatures soaring above 90 degrees and high humidity for over a month. These things had medical effects. And the cosmonauts were very glad that I was a trained physician. I did a lot of treating up there.

So the local atmosphere turned out to be a major problem.

The fundamental things you need to be concerned with is ensuring that you have breathing air, that you've got carbon dioxide scrubbed out, and you don't have contaminants in the atmosphere. With system failures, all of those became concerns. From time to time we had to wear filter masks throughout the day. I was very busy medically, busy as a scientist, and busy as a cosmonaut doing repairs on the station. It was as hard as I've every worked in my life. It was literally 24 hours a day, 7 days a week. Of course, a week is hard to define because there's really no marker of time. We artificially used Moscow time on our wristwatches. I'd shave every Sunday morning to help mark the week. And shaving is not trivial. It takes 45 minutes or so to shave with a straight blade because you

Left: Cosmonaut Vasili V. Tsbliyev works on *Mir* during a space walk with Jerry Linenger. The two spacemen deployed scientific instruments and retrieved other science hardware.

have to wipe every stroke of your beard into a towel to keep it from floating. You either do it that way or else you will be breathing your whiskers.

Did you regularly have contact with Houston during the mission?

I had no contact with Houston the entire time. People think you're up there chatting away with the ground, but you're really not. The only communications we had were with Mission Control in Moscow. There was a small group of NASA representatives there and every so often I would be able to talk to them but that was pretty rare. In general, our communications passes were very limited, maybe 5 minutes every 90 minutes if we were lucky. Sometimes we didn't even have that. And most of that time was spent with controllers giving us repair instructions. So I had very little opportunity to speak with the NASA side, and therefore I had very little opportunity to get any feedback on the experiments. I had 5 months of doing experiments and trusting my own training and educational background with very little feedback and very little help from anyone.

So most of the things you did required your coming back before you could evaluate results.

That's right. You pour your heart and soul into your work and put in long hours so you are definitely keeping your fingers crossed post-landing. Did the computer record the results correctly? Did I load the film correctly? Was my exposure set correctly? Feedback is a good thing and when you have to wait 5 months for it it's a disadvantage.

In reality, we did very well. We had 100 percent success in all the science we carried out; we were able to get it done despite all the other difficulties we had up there despite all the time doing repairs and spacewalks. As a matter of fact, we ended up with more pictures than I took up film for. And that worked out because I found some floating film behind a panel that Shannon Lucid had left behind. That's over a hundred percent success!

When you were in Washington at the Surgeon General's Leaders' Conference, you talked about some of your feelings looking down at the earth and seeing evidence of man.

The earth is magnificent. But signs of man are very evident. Flying over South America, I could see a thousand points of light—fires where they were clearing the jungle. The smoke pall traveled half way across the Atlantic Ocean. The same thing in Mongolia. There, they are clear-cutting the forests and burning. In China I tried to get a picture of Beijing, but for 5 months I could not get a clear picture because of the combination of either smoke, clouds, or smog. Every city is a gray smudge on the surface. Every city—I don't care if it's known for its parks or whatever, from space every city is a gray blotch. You can definitely see the effects humans have had. It's ugly. The land is denuded and you can see all that plainly from space.

Did you get a chance to look in the other direction—up toward the sky? Could you see Hale-Bopp?

Hale-Bopp was a huge flashlight just dominating the entire sky. Sometimes, before bedtime, I'd look at the stars. You can see millions of stars and it's mind-boggling. When you're in space and look out you see so many stars, your mind tells you there's a high probability that there's some other form of life out there.

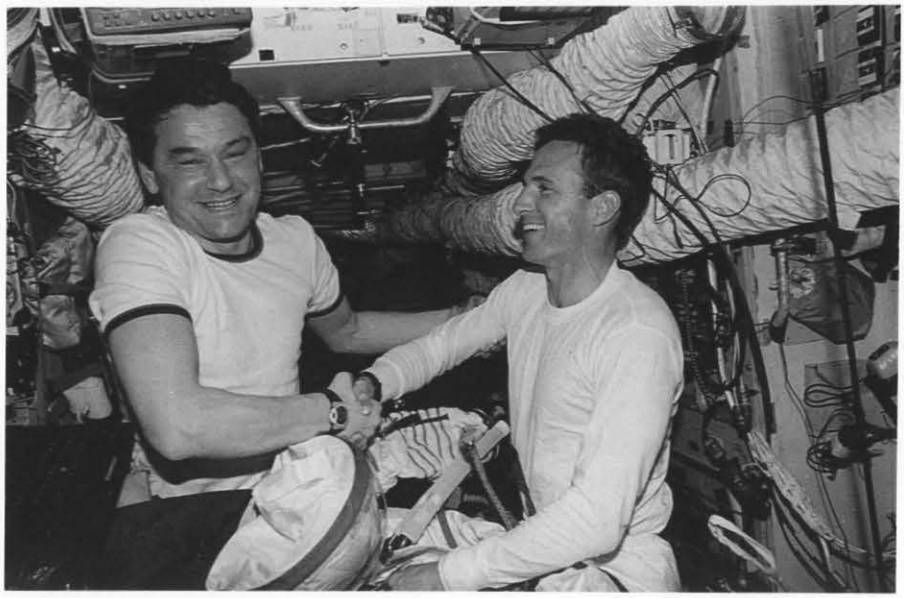
You talked about communication and the fact that it was very limited. How about with your family? Did you have things like E-mail?

My wife came to Russia to try to improve our chances of being able to talk. They did have the capability to do a video downlink and uplink where it would be possible for me to see her and she see me. But that system had only one successful pass in 5 months. E-mail was possible. I would tag my personal E-mail to the end of experimental results but the downlink for that was maybe once a week if we were lucky, and you had to limit it to about 5K. So I would use elementary word processing and little short notes. We had about a 2-week lag between anything I sent her and any response. Eventually, I got to the point where instead of getting frustrated I changed my attitude. I had to realize that I was out on the frontier; I'm an explorer and it's very similar to the exploration of old where you went out on a ship at sea and were gone for 5 months. Then you caught up on things when you got back. With that attitude, it was easier to tolerate the lack of communication.

We were listening to the letters to your son John on National Public Radio. How did those come about?

I usually wrote a letter to my son every night before I went to bed. As

Right: Two new partners, cosmonaut Valeri Korzun and astronaut Jerry Linenger share a laugh. *Opposite page:* Shuttle astronaut John Grunsfeld assists Linenger in donning his space suit aboard *Mir*.



things got more serious up there my letters became more serious. I think I was trying to pass things along to my boy in the event that something bad might happen. I typed them on the computer in elementary word processing and then I'd try to send it down at the back end of data files from experiments. In Mission Control Moscow, my NASA group would peel those off and send them to my wife. When people became interested, I agreed to put them on the Internet. And then NPR heard about it. So they had me read one during communication passes once every few weeks.

You've already alluded to the level of Russian technology. Here was a space station that was 11 years old.

Russian technology is brute strength mechanical engineering and that's the big difference between our space products and theirs. It's pretty good mechanical engineering when you think of some of those systems lasting 11 years. But at this point, it's like an old car. More and more time is spent keeping the car running. It's the same thing with a space station. Mechanical parts break down and you spend more and more time as the years go on taking care of the systems. Unfortunately, that means less time to do your productive work—the science, the space operations.

You had some harrowing experiences. One involved a rendezvous and docking with a *Progress* rocket and the other was the fire.

We had three occasions when we were ready to evacuate and had the *Soyuz*—the rescue vehicle—ready. One was near-collision with the *Progress*, one was the fire, and the third was a combination of oxygen system and carbon dioxide scrubber failures, and lack of backup canisters. The last crisis was a supply sort of thing. We started counting our supplies and realized we needed more canisters in a resupply vehicle or we wouldn't be able to stay up there breathing.

I've talked a lot about the fire and I think most people know about it. It was a 15-minute, 2-foot, blowtorch-like directional fire in an oxygen canister so it had fuel. You're in a closed environment with nowhere to go, and it's like being shipboard in the middle of a battle. You've got a fire and you have to fight it. Aboard ship, you can escape to the deck. In this case, you couldn't open a window and there was literally nowhere to go.

How did you fight it?

Step one was to make sure we were going to survive to fight it so we put on our oxygen respirators. Smoke got very dense very quickly. Within 30 seconds you couldn't see your hand in front of your face and you couldn't breathe the atmosphere. In space, smoke doesn't rise; you're weightless and the smoke is also weightless so there's no clear spot down low. Once we got our respirators on, two of us grabbed fire extinguishers and started fighting the fire like you would on earth. However the fire extinguisher acts as a thruster up there so we had to brace ourselves in order to fire it.

What kind of extinguishers were they?

Water-based. Again, it would be nice to have other fancy things, but everything would end up in our atmosphere. So you can't have any fancy gases that might be toxic. The water in our extinguishers turned into steam because that fire was burning at probably twice the melting point of aluminum. We were not going to put it out. All we could do was contain it and keep the secondary structures from igniting by using the extinguishers. We also cut off the fans throughout the space station so the air would not circulate. In that micro-environment, the fire eventually was starved of oxygen. For example, a bulkhead would start to burn and then it would put itself out because the oxygen was not replaced. Because

warm air didn't rise next to the fire, fresh air didn't come up next to it. Therefore, in that micro-environment, you get a boundary layer devoid of oxygen and full of burn products.

What was the aftermath?

I'd call it a medical emergency. I set up a tracheostomy station and had all the gear out. I kept everyone on the respirators as long as possible while the environmental support systems were helping clear the air. The condensate from the water vapor on the cold hull took a lot of the soot and particulates out of the air. After that, I put 3M filter masks on everyone and started listening to lungs, getting percent oxygen in the blood on everyone, and setting up a baseline.

I was also concerned with contamination control. Everyone washed, and we bagged all the components that had burned to keep the more toxic particulates from getting into the air. I did the best I could to isolate that material. I did about 48 hours worth of exams on people and took air samples. I also stored air samples in a vacuum cylinder to measure how well the atmosphere was doing for postflight analysis. I wanted to see what we had been exposed to. I also treated a few burns.

Did the atmosphere pretty much clean itself up in time?

We stayed in the 3M industrial filter masks about 48 hours. The problem was we simply didn't have enough respirators with oxygen. We wanted respirators ready should there have been a second fire. So we chose to go with the filter masks, even though there was some remaining smoke.

In an environment like that where things are breaking down on a regular basis, it seems that all of you were being stressed to abnormal limits.

It's like being aboard a ship at war and you've taken some damage. You've got a few flooded compartments and some broken gear, and you've got a threat around you. That's a good earth analogy to what it's like to live up there and what your concerns are. When you have a fire and a near miss, you realize anything can happen at any moment. When a master alarm goes off you're right on top of it.

How was your own psychological health?

I kept very good account of my own psychological health and I think I held up very well. My Navy training and background paid off, especially in deal-

After 5 months in orbit, Linenger briefs his replacement aboard *Mir*, Michael Foale.

ing with the stress of isolation, although isolation was almost minor compared to the other life-threatening things I'm talking about. I also realized that any action I took could have very serious consequences, especially if I made a mistake. For example, disconnecting the wrong cable, pushing the wrong button. Those things can lead you into a downward spiral.

You had your first EVA (extravehicular activity) while aboard *Mir*.

You open the door and it's very similar to climbing out on the wing of an airplane. All of a sudden you feel the speed. Inside the station, you know intellectually that you're going fast. You're seeing cities going by every couple of seconds. But when you open the hatch and climb out on the convex exterior of a space station, you feel like you're falling off a cliff and all of a sudden you get the sensation of 18,000 miles per hour. And I've never gone 18,000 miles an hour, at least not outside! It's an overwhelming feeling. Based on your training and because you've been in tough situations before—flying on carriers and doing all the things we do—you learn to compartmentalize that fear away. You still have the feeling of going 18,000 miles an hour and falling off a cliff but you are able to tuck it away and get the job done over the next 5 hours. But I will never forget doing that space walk. It was the ultimate bungee jump.

During your first flight aboard the shuttle you used the treadmill for exercise. You also used a treadmill aboard *Mir* but using it was a real chore.

Exercising is not fun in space. Your body likes floating. It likes being under nonstress. Twice a day, for 1 hour each time, you have to strap yourself in and yank down on your shoulders with 70 kilograms to hold yourself in place. As the treadmill gets turning and you start running, your body revolts and says, "I'd rather keep floating." Sometimes you feel like you have pins being driven into the soles of your feet. They're not used to the pressure. You're constantly readjusting the harness because it's yanking down on your shoulders or grating on your hip. It takes dedication to work out during that 1-hour period twice a day. But you have to do it. It's important for your health.

It was also important for me to be able to walk off the shuttle at landing. You have to keep yourself in shape and do the best you can to counteract what is essentially bed rest for 5 months. Actually, it's even worse than bed rest because you're getting absolutely no resistance whatsoever. I worked very hard at it and tried very hard to conserve my bone mass. That's another thing that suffers in the space environment.

Were the cosmonauts as religious as you were about exercise?

They carried out the program, but not as religiously. I think there still are some cultural differences. In Russia, you don't see many people jogging at lunch. Tobacco use is probably a lot higher over there than here. Russians are not used to exercising even on earth and when you get in space it's a lot tougher to do it.

What was the food situation aboard *Mir*?

I ate a lot of Russian food out of tubes—jellied fish, borscht. I also had American food aboard. We had almost a 50-50 mix of shuttle food and Russian food. To be honest, any food that was different after 5 months tasted good.

What did you want to eat when you came home?

I think I asked for some good old meatloaf and potatoes. When you come back, your gyros [gyroscopes] are not

synched quite right so when you move your head a little bit you get some spin sensation. I think it's safe to say that I was probably a bit disappointed with my first meal. When I came back I was content to have a light meal and wasn't ready to chow down quite yet.

When it was time to come home, you must have been chafing at the bit.

There are great Navy analogies to all of this because it's the same kind of isolation being away from family and friends. If you go out on a cruise and you know it's going to last 6 months, you set your mind to go through 6 months. I did the same thing. I knew I had a 5-month mission and in my mind I was going to make it from start to finish. I was busy and productive the whole time. I never said, "I've got to get off this thing." I was working very hard right up to the very end.

If there had been a delay in the shuttle launch, I think that would have been tough to handle. Near the end you start marking the days off the calendar but you work hard from start to finish and you try to complete the thing right.

How did you feel when you saw the shuttle coming toward you?

Fantastic! Total elation. It was pure joy to see the space shuttle coming up. First of all, it was spectacular to see it. And in my case, it was my ride home. I was keeping my fingers crossed that everything went well during docking. Once the hatch opens, you keep yourself close to the shuttle at all times. In case of an emergency I was definitely going to end up on the shuttle side of that closed hatch!

Because of your physical condition, did you feel any different about this homecoming reentry than you felt during your first shuttle flight?

I was in a recumbent seat instead of sitting upright and because of that I had no hypostatic problems whatsoever. No. I didn't feel much different than a shuttle reentry after 10 days. Post-landing, it was tough getting up and walking but there wasn't a huge difference from shuttle landings after 10 days. It's an individual thing. If you were an outside observer watching the crew getting off, at least immediately after landing, you probably wouldn't pick me out as being any different than the other crewmembers.

However, the recovery after that is a different story. I was in space 5 months and it took about 5 months to get back where I could go run and lift weights and feel normal again.

How about bone loss?

I had bone loss and haven't made up for it yet. I recently had a DEXA scan followup. For example on the hips, I was down around 12 percent and now I'm sitting around 7 percent. And that's 5 months out. It's going to take time. I'm working out hard trying to get it back mainly with weight training at this point. I did a lot of water training early on to avoid getting stress fractures. Walking came next, then slow jogging, and now I'm lifting more and more weights. Does it feel any different in my hips? Not really.

Any other changes that you notice besides bone loss?

One of perception. I'm still three-dimensional on earth. When I look at a building, I see volume not floor space. So if I give a talk in a large auditorium I think, "Wow I could put 100,000 people in this place!" I still see the ceiling as a viable place to sleep. So I haven't totally shifted my perspective back to two-dimensional. I'm waiting for it to click in one day.

We have another astronaut up there now and another going up after him. Do you think the *Mir* missions are still worth the effort?

We've gotten a lot out of the *Mir* missions. You've got to be out at sea to really know what it's like to be out at sea, and you learn things every day. It's the same thing with space. You learn things every day in space. We're gaining valuable experience. On the other hand, I'm looking forward to the new space station. There will be fewer maintenance needs and more science can get done.

You are retiring in December. What's in store after that?

I have had a great stay in the Navy but now I want to live in a place of my own choosing and not dependent on a job. I also want to spend some time with my family. Medicine is not an option right now nor is anything further in the space program. I want to do something that's fun in the sense of a steep learning curve, but there are no hard plans right now in terms of a particular job.

I guess it's hard to top flying in space.

That's true. I've done a lot of traveling—2,000 orbits and 50 million miles. Staying put for awhile, having some home-cooked meals, and not sucking food out of tubes sounds pretty attractive.

Astronaut David Wolf, who replaced Michael Foale aboard Mir, *returned in January. Andrew Thomas, his replacement, will be aboard the Russian space station until late May. He is the last American astronaut scheduled for a* Mir *mission.* —JKH

NOSTRA: Military Lens Crafters

HMC(AW/FMF) George Hoover, USN

The Naval Ophthalmic Support and Training Activity (NOSTRA) in Yorktown, VA, has been the military's premier lens crafters for more than 50 years. The Navy Ophthalmic Program started in 1942 with truck-mounted optical units. In 1945, 65 spectacle dispensing units were established within the United States, fitting eyewear made by civilian companies. A 5-week school at the Naval Medical Supply Depot, Brooklyn, NY, trained personnel for these units. The eyewear contract was discontinued in 1949. The Surgeon General of the Navy directed the establishment of the Navy Ophthalmic Program on 1 July 1949. Two Navy Ophthalmic Lens Laboratories opened, one at the Naval Medical Supply Depot, Brooklyn and another at Naval Supply Center, Oakland, CA. Twelve additional optical support units (OSUs) were made operational.

The Optical School relocated to the U.S. Naval Medical School, NNMC, Bethesda, MD, in July 1950, and was redesignated the Optometric Fabrication School. Personnel previously designated as spectacle dispensers were recalled for further training and designated Optometric Fabrication Technicians.

The Brooklyn Laboratory was moved to the Naval Supply Center, Edgewater, NJ, in 1950, remaining until 1954 at which time it was moved to Cheatham Annex Depot, Naval Supply Center, Williamsburg, VA, and was redesignated the Naval Ophthalmic Lens Laboratory. The laboratory in Oakland was disestablished on 1 July 1958, and on 1 July 1964, the remaining laboratory was renamed the Naval Ophthalmic Support Activity (NOSA).

The Naval Opticians School was relocated to NOSA and the activity was granted command status as the Naval Ophthalmic Support and Training Activity (NOSTRA) on 6 May 1968. On 1 Feb 1973 lab production moved to the Naval Weapons Station, Yorktown, VA. The command was completely relocated in May 1974.

On 8 Aug 1990, NOSTRA's mobilization for support of Operation Desert Shield began. During the next 20 days, 47,539 pairs of glasses were made; 18,000 of which were delivered to deploying forces with same-day or next-day delivery. Seven-day work weeks, extended work hours, and enhanced productivity met this operational commitment, while still providing routine services to all other activities. Between 1 Oct 1990 and 28 Feb 1991, almost 300,000 pairs of eyewear were produced with over 151,000 pairs sent to over 500 different activities within 48 hours of their request. NOSTRA was awarded its 3rd and 4th Letters of Commendation from the Secretary of the Navy for outstanding service.

In November 1992, the Chairman of the Joint Chiefs of Staff ordered a review of military training to ensure maximum training effectiveness and combat readiness; his goal was to identify programs that could benefit from consolidation in order to reduce cost. The Interservice Training Review Organization (ITRO) is carrying out this mission. The Navy's Optician School (HM 8463) was soon to change.

The subcommittee evaluated the curriculum, length of training, logistical support, facility requirements, student load, and instructor manning. This group reviewed Army Ocular Technicians (91Y), Army Optical Laboratory Specialist (42E), Navy Ocular Technicians (HM-8445), Navy Optician (HM-8463), and the Air Force Optometry Technicians. They determined that all opticianry training should be conducted at NOSTRA because it was the most cost-effective location.

Above: **Naval Ophthalmic Lens Laboratory, Cheatham Annex Depot, Naval Supply Center, Williamsburg, VA, circa 1956.** ***Left:*** **Naval Ophthalmic Support and Training Activity, Naval Weapons Station, Yorktown, VA, circa 1994.**

The last all-Navy class graduated on 3 Nov 1995, and the Tri-Service Optician School (TOPS) began its first class. Members of the Army and Navy now train together in a 24-week course. TOPS has four classes each year, made up of approximately 140 students: 80 Army and 60 Navy. Air Force students will be trained as the need arises. The consolidated/co-located course maintains an accreditation by the Southern Association of Colleges and Schools, and the Commission of Opticianry Accreditation.

In February 1996, the crews of USS *Theodore Roosevelt* (CVN-71), and USS *Mount Whitney* (LCC-20) were asked to participate in a test project, determining the variety of frame styles eventually offered in an initiative called the Frame of Choice Program. The idea was to replace the standard military issue spectacles with frames that responded to the needs of mission readiness, safety, and personal choice.

NOSTRA sent a team of five opticians to both ships, bringing with them a wide selection of frames. The crew made their choices, frames were fitted, and prescriptions were transcribed. The team returned to NOSTRA and the eyewear was fabricated. When they returned to the ships, the glasses dispensed to the patients had little resemblance to what NOSTRA normally manufactures.

The team returned once more to the ships and conducted a survey. Patients were interviewed regarding their likes and dislikes, and any problems encountered while carrying out their normal duties with the different frames. Both commands expressed overwhelming support for the program. Having a choice is a definite quality of life issue and the benefits are increased use of military frames without sacrificing safety or operational compatibility.

On 9 Oct 1996, the Navy's Surgeon General authorized the implementation of the Frame of Choice Program. There are approximately 605,000 personnel who wear corrective lenses on active duty in the Armed Forces; 245,000 are Sailors and Marines. ❑

When this article was written HMC(AW/FMF) Hoover was NOSTRA PAO. He is currently assigned to USS *John C. Stennis* (CVN-74).

BUMED Archives

Right: All three of *Maine*'s enlisted medical personnel were killed when the battleship exploded in Havana Harbor on 15 Feb 1898. *Opposite page:* A vintage stereoscope card showing the wreckage of the sunken *Maine*. One of the ship's two masts is now at the U.S. Naval Academy; the other is in Arlington National Cemetery.

Remembering the *Maine* 100 Years Later

HMCS(FMF) Mark T. Hacala, USNR

On a warm Tuesday evening a century ago, the USS *Maine* went to the bottom of Havana Harbor after a violent explosion. That catastrophe signaled the beginning of the Spanish-American War. Most Navy medical histories focus on results. On the hundredth anniversary of this tragedy, it is appropriate to reflect for a moment on the event.

Through the 1890's, a popular movement promoting Cuban independence from Spanish control met with increasing repression. Spanish authorities, attempting to control rural civilians who might aid Cuban rebels, crammed the unfortunates into concentration camps where as many as several hundred thousand *reconcentrados* died of disease and starvation. Fueled by the spin of such newspaper publishers as William Randolph Hearst and their brand of sensational journalism, Americans were very aware of the Cubans' plight. Washington protested the violations of human rights, and private American groups supported rebel efforts. Madrid saw Yankee preoccupation with Cuba as meddling in Spain's affairs.

In January 1898, the 2-year-old battleship, USS *Maine*, was sent to Havana as a symbol of American concern over the tension in Cuba. The ship had a crew of 290 Sailors, 26 officers, and 39 Marines. Spanish officials respectfully tolerated the *Maine* but Spanish citizens in Cuba took the uninvited vessel's presence as a slap in the face. Although there was threat of trouble, a 3-week visit had passed without incident... until the evening of 15 Feb.

At 9:40 p.m., an explosion rocked the forward part of the ship. A second

Author's collection

explosion quickly followed. Centered below enlisted berthing, the blasts ruptured bulkheads and the ship's bottom. In a short time, the proud battleship was a total loss.

Rescue efforts came from ships moored or under way nearby. Boats from the merchantman *City of Washington* and the Spanish cruiser *Alfonso XII* aided the *Maine*'s three boats in pulling burned and injured men from the water. Once ashore, casualties were rushed to Havana hospitals for treatment. Among the caregivers that night was a humanitarian in her seventies who had come to Cuba to oversee the distribution of aid from the United States—American Red Cross founder Clara Barton.

Casualties were staggering. Seventy-three percent of the crew died. Two hundred fifty-one enlisted and two officers were killed by the explosion or drowned; seven would later die of wounds. Only 16 of the 102 survivors were uninjured. Of the ship's medical department, only Surgeon Lucien G. Heneberger lived through the blast. All three enlisted medical personnel, two nonrated men and a chief petty officer, perished.

15 Feb 1898
Bayman Fritz Boll, USN
Bayman Thomas Cole, USN
Apothecary Walter S. Sellens, USN

Americans were horrified and outraged by the tragedy. On 21 Mar the Navy's court of inquiry reported that the *Maine* had been sunk by an external mine (a conclusion debated ever since). The public, already whipped to a frenzy, demanded vengeance. "Remember the *Maine*! To Hell with Spain!" became the nation's battle cry.

The sinking drove the United States into what became known as the "Splendid Little War" against Spain, a short, lopsided contest from which the United States emerged with its own overseas empire and all the requisite responsibilities of a global power.

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Hospital Corps Hero and Historian:

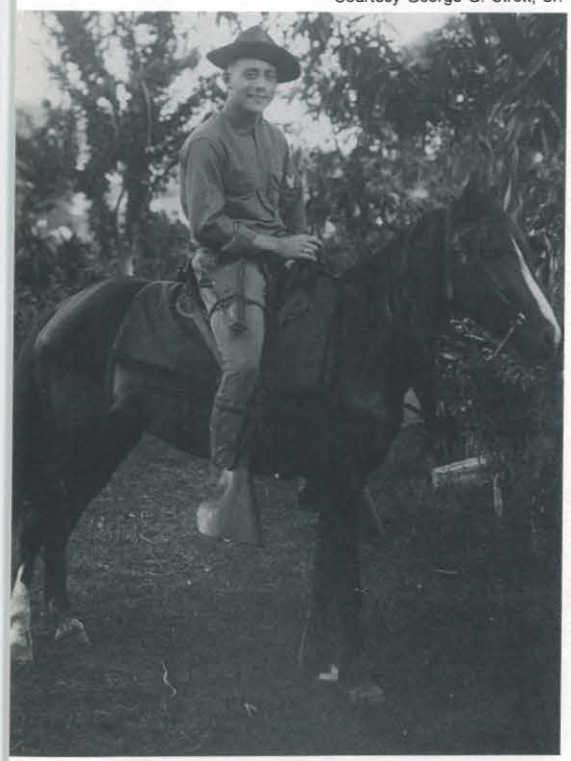
George G. Strott

HMCS(FMF) Mark T. Hacala, USNR

In every period of its history, members of the Hospital Corps have displayed dedication and commitment worthy of recorded history. Among them is one who served in combat and peacetime as a caregiver, teacher, and administrator. But it is not only important that George G. Strott made Hospital Corps history. He wrote it as well.

Strott's experience as a regimental leading chief petty officer in World War I galvanized his commitment to the Hospital Corps. He proved himself on the battlefield, earning the Navy Cross and many other decorations. In tribute to his fellow medical Sailors, Strott spent the next three decades creating a record of Navy medicine's participation in the Great War, ensuring that hospital corpsmen in the next century would know of the valorous exploits of their predecessors in 1918.

Courtesy George G. Strott, Sr.



Chief Pharmacist's Mate George Strott prior to World War I. Between 1915 and 1917, Strott served with the 17th Marine Company which performed pacification duties in Haiti, Cuba, and the Dominican Republic. Note Navy rating badge trimmed and sewn to USMC shirt.

Born in Pittsburgh, PA, on 31 May 1894, Strott began a fascinating and productive Navy career in 1912. Over the next 5 years he would serve at the Washington Naval Hospital and with the Marines who comprised the *gendarmerie* or police force in Haiti. His service overseas prepared him as well as possible for the ultimate duty of combat.

World War I

The United States entered the war in Europe in April 1917. At Quantico, VA, Strott was advanced to chief petty officer and joined the newly formed 6th Marine Regiment. That regiment, along with the 5th Marines and the 6th Machine Gun Battalion, would form the 4th Brigade of the Army's 2nd ("Indian Head") Division in the American Expeditionary Forces (AEF) in France.

Strott and his fellow Sailors and Marines faced a new and horrifying war which had ground to a stalemate in France. He risked his own safety many times on the battlefield to treat and evacuate casualties. Chief Strott was wounded twice, once in a poison gas attack and once by shrapnel to his left eye. Of his exposure to gas, Passed Assistant Surgeon Joel T. Boone (later an admiral and recipient of the Medal of Honor) said, "This man frequently disregarded his own symptoms sacrificingly in order to care for the many wounded."

Throughout the war, Strott displayed noteworthy courage. From October 1917 until war's end 13 months later, Strott earned two wound stripes (later the Purple Heart Medal). Service with the 6th Marines entitled him to wear the French Fourragère permanently. For his bravery and efficiency in action, Strott was commended five times in official orders. He received the French Croix de Guerre (Gold Star or Second Class), and *four* Silver Star Medals. For his heroism at Belleau Wood, when he left shelter at night to retrieve wounded in the midst of an artillery bombardment, he received the country's second highest decoration, the Navy Cross.

Strott's capabilities did not go unnoticed. In May 1919 he was given a temporary appointment to the warrant officer grade of pharmacist at the request of division commander MAJGEN John Lejeune and AEF commander GEN John Pershing.

Postwar Duties

Following occupation duty in Germany, Strott returned with the Marines to Haiti from December 1919 until 1921. Once again, he wore the two hats of Navy hospital corpsman and Haitian Gendarmerie contract surgeon. While there, Strott's bravery during a bandit raid earned him the Médaille Militaire d'Haiti (Haitian Military Medal).

Strott's duties over the next several years took him to several locations,

Courtesy George G. Strott, Sr.

Pharmacist Strott on occupation duty in Germany between May and August 1919. The Indian head and star formed the patch of the U.S. Army's 2nd Division, whose 4th Brigade was made up of Marine Corps and Navy medical personnel.

including the presidential yacht USS *Mayflower*, and the Naval Hospital in Washington. He finished his "first" Navy career at the recruiting station in Cleveland, OH, transferring to the Fleet Reserve in February 1930.

Recall

After 10 years as a civilian lab technician, Strott was recalled to active duty in November 1940. As a chief pharmacist's mate, he taught for a year at the Hospital Corps School in Brooklyn, NY. He then came to the Bureau of Medicine and Surgery in early 1942.

George Strott left a great legacy during his years of service in World War II. Commissioned as a Hospital Corps ensign in August and ultimately rising to the rank of lieutenant, Strott was editor of the *Hospital Corps Quarterly* from 1942 until 1946. This magazine, published monthly during the war, provided technical and professional information, feature articles on hospital corpsmen in action, and lists of casualties and those decorated during the war. The information contained in these issues will continue to be of great value to future historians. Two sections of the publication, the Hospital Corps Archives and first-person accounts of combat action, preserve the rich character of our predecessors.

At the end of March 1946, LT Strott returned to the retired list, his final work about to be released.

History

George Strott showed a great aptitude for detail in recording individual events. He had been commended in World War I, having, "painstakingly compiled the casualty reports and his services in this respect have been invaluable to the Regiment." His ability for detail work and his pride in the Hospital Corps led him to commence a project of great magnitude.

While at the Naval Medical School in 1927, Strott began accumulating data on naval personnel assigned to the AEF in World War I. He continued to research and compile data after leaving the Navy, resuming his efforts with vigor upon his return to BUMED in the 1940's. For 20 years he collected information from the Navy and War Departments, the Marine Corps, and fellow veterans.

The fruit of Strott's labor was NAVMED 1197: *The Medical Department of the United States Navy with the Army and Marine Corps in France in World War I.* Published by BUMED in June 1947, this work is the only narrative history of Sailors with the Marines in France. Additionally, Strott included exhaustingly thorough lists, detailing every hospital corpsman, doctor, dentist, and chaplain who served, every wound they received, every campaign in which they participated, and every decoration earned by every man. It is doubtful that any other military organization of the period has as complete a personnel history as does Navy medicine.

Courtesy George G. Strott, Jr.

George G. Strott as a Hospital Corps lieutenant (junior grade). His decorations tell his story in action: the Navy Cross, four Silver Stars, two Purple Hearts, two Haitian Campaign Medals, two Expeditionary Medals, the World War I Victory Medal with five stars for commendations, the Military Medal of Haiti for bravery, the American Defense Service Medal, four Good Conduct Medals, the French Croix de Guerre for heroism, and the Occupation Medal for post-World War I service in Germany. The bar on his pocket is the French Fourragère, normally worn as a shoulder cord.

George Strott died on 5 April 1953. His efforts to document the epic of the Hospital Corps in two wars, both in the *Hospital Corps Quarterly* and in his World War I book, left invaluable resources of Navy medical history. He was buried in Arlington National Cemetery, a hospital corpsman who served his Navy and left a record of his shipmates' valor and sacrifice.

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Naval Medical Research and Development Command Highlights

•Navy Researchers Testing Oral Vaccine Against Travelers' Diarrhea

Campylobacter is a leading cause of travelers' diarrhea and a serious threat to deployed military forces. For example, the reported diarrhea attack rates of U.S. military personnel during exercises in Thailand have consistently approached 50 percent. Of these, up to 60 percent have been due to *Campylobacter* infection, and more than three-quarters of the isolates are resistant to commonly used antibiotics. Although most *Campylobacter* episodes are moderate and self-limited, about one-third are incapacitating. *Campylobacter* causes at least 2 million clinical cases of diarrhea per year in the United States, and there are over 400 million individuals worldwide who suffer from the disease each year. Recognizing this threat, researchers at the Naval Medical Research Institute, Bethesda, MD, collaborating with the U.S. Army Medical Research Institute of Infectious Diseases, Ft. Detrick, MD, and industrial partners Antex Biologics, Gaithersburg, MD, and SmithKline Beechman Biologicals, have developed an oral *Campylobacter* vaccine. The vaccine is composed of *C. jejuni* bacteria that have been formalin-inactivated, and is administered with a new oral adjuvant. Phase I studies showed that the vaccine was safe and immunogenic. These landmark studies were the first successful clinical evaluation of the oral vaccine, and the first to show immune-enhancing activity. Phase II trials are now under way. An easily administered *Campylobacter* vaccine for forward deployed military personnel will have a positive impact on military readiness and mission performance.

•Adenovirus Epidemics: Navy Researchers Leading Triservice Surveillance Effort

There are over 40 different adenoviruses, found in all parts of the world, which cause a variety of respiratory diseases, including the common cold. Before the routine administration of adenovirus vaccines to military recruits in the 1960's, 10 percent of recruits became infected and 90 percent of this group developed pneumonia. For nearly 30 years, adenovirus vaccines have reduced acute respiratory disease (ARD) morbidity among recruit populations. However, the sole manufacturer of the vaccines ceased production and epidemics of adenovirus infections are imminent among recruit populations. These epidemics will severely impact military training and may overwhelm military treatment facilities. DOD is actively seeking a way to resume production before current vaccine supplies are depleted by spring 1998. In the meantime, Navy scientists at Naval Health Research Center (NHRC), San Diego, CA, and collaborators from eight other Army, Navy, and Air Force commands are conducting clinical epidemiological studies to determine the prevalence and distribution of adenovirus serotypes among military trainee populations. Five training sites are the focus of these studies; Marine Corps Recruit Depot, San Diego, CA; Naval Recruit Training Center, Great Lakes, IL; Fort Leonard Wood, Waynesville, MO; Fort Jackson, Columbia, SC; and Lackland Air Force Base, Lackland, TX. Once a month, specimens are shipped to NHRC where researchers document adenovirus infections and isolate the serotypes. Preliminary results suggest that the adenoviral vaccines are effective in controlling the targeted serotypes but unusual serotypes of adenovirus are also causing respiratory diseases. These data are important in determining prevention strategies and defining vaccine development priorities to improve military readiness and reduce medical care costs.

For more information on the Naval Medical Research and Development Command contact the homepage at http://www.dmso.mil/NMRDC/

For more information on these and other research efforts contact Doris M. Ryan, Deputy Director, External Relations, at DSN 295-0815, Commercial 301-295-0815, E-mail ryand@mail-gw.nmrdc.nnmc.navy.mil, or FAX 301-295-4033.

In Memoriam

CAPT **Adolph Richard Dasler**, MSC (Ret.), a pioneer in the study of thermal stress, died on 16 Nov 1997 at NNMC Bethesda, MD, of a cerebral hemorrhage. He was 64.

CAPT Dasler was born in Conklin, MI, and joined the Navy as a hospital corpsman. He served in Iceland, the Mediterranean, Korea, and French Indochina, and had duty aboard PCE-845, USS *Noa* (DD-841), and USS *Haven* (AH-12), and saw field medical duty with the First Marine Division.

After being discharged in 1955 he commenced full-time academic studies, receiving a B.A. degree in physiology and public health from Western Michigan University. He then received a commission in the Medical Service Corps in 1961 and reported to the Naval Medical Research Institute in Bethesda, MD. In 1966 he received his Ph.D. in physiology from Michigan State University.

Dr. Dasler was appointed Head, Heat Stress Laboratory and Head, Thermal Stress Section at the Naval Medical Research Institute, Bureau of Medicine and Surgery, and the Naval Medical Research and Development Command. His research determined that personnel should rely on food intake rather than salt tablets to restore nutrients lost during physical activity. In the 1970's he developed a system for military bases to regulate exercising in hot weather.

CAPT Dasler served in Vietnam and with the Army in Panama. In 1979 he was assigned as Special Deputy for the Navy Occupational Safety and Health to the President, Board of Inspection and Survey, and Special Advisor to the Secretary of the Navy. He personally conducted over 400 Navy occupational safety, health, and medical inspections aboard vessels of the U.S. Fleet. After his retirement from the Navy, he was an environmental physiology consultant to several federal agencies and international companies. He was also a member of the American Red Cross Advisory committee.

CAPT Dasler held the Legion of Merit, Navy Meritorious Service Medal, Navy Commendation Medal, Presidential Unit Citation (Vietnam), Navy Unit Commendation (Vietnam), Meritorious Unit Commendation Citation, Navy Good Conduct Medal, Navy Occupation Medal (Europe), National Defense Medal (three awards), Korean Service Medal, Vietnam Service Medal (two campaign stars), Korean Presidential Unit citation, Vietnam Presidential Citation (French Indochina), Vietnam Cross of Gallantry with Palm, United Nations Service Medal (Korea), and Republic of Vietnam Campaign Medal. He also received 12 professional honors outside the Navy.

CAPT **Collister M. Wheeler**, DC, USNR (Ret.), died 14 Oct 1997 in Portland, OR. He was 104.

Dr. Wheeler was born 20 June 1893 in Portland. He joined the Navy in World War I before attending dental school, then served aboard ship in the Pacific during World War II as a dentist. During the Korean War, Dr. Wheeler headed the dental reserve program at the Bureau of Medicine and Surgery.

Following a 42-year private practice, and at age 82, Dr. Wheeler became interested in age-group sports competition in swimming and in track and field. In his early years, he had boxed and been a canoeist and weightlifter. At age 90, he went to New Zealand to compete in an international age-group swimming competition. His interest in working out and in age-group competition continued until he was 100. He excelled in track and field and in swimming. Throughout his life he set 16 world age-group records in swimming and another 15 in track and field.

In Their Own Words:

World War II Medical Personnel Tell Their Stories

Deep in the archives and libraries of Navy medicine are the stories of the men and women of World War II who treated the Sailors and Marines from Pearl Harbor to Okinawa. In many ways, they were the most intimate witnesses to the grossest horrors of war, caring for comrades ripped and burned by battle, wasted by disease, gripped with despair.

Their testimony might have been lost to all but the hardcore historian, the nuances of their experiences lost to time. But thanks to naval historian Jan K. Herman, their accounts have been preserved.

Herman spent more than 10 years interviewing dozens of Navy physicians, nurses, and hospital corpsmen who served during World War II, capturing their recollections on tape, and then transcribing and editing them in a book, *Battle Station Sick Bay: Navy Medicine in World War II.*

Here are stories ranging from poignant, long-forgotten incidents told with humor and pathos to the incidents mythologized by Hollywood into the almost unrecognizable.

Perhaps the best known tale of Navy medicine to come out of World War II was depicted in the 1943 film, "Destination Tokyo" starring Cary Grant. The movie includes the heroic account of how a corpsman (then called pharmacist's mate) removed a shipmate's appendix while their submarine withstood an avalanche of Japanese depth charges.

The truth, according to the pharmacist's mate who performed the operation, Thomas A. Moore, was only slightly less dramatic. Moore had finished his emergency surgery and his patient, Fireman Third Class George Platter, had been in his bunk for a good 10 minutes before the Japanese began dropping depth charges.

"Platter spent his postsurgical night with about 3 or 4 hours of depth charging. In fact, he got knocked clear out of his bunk at one point," recalled Moore.

LCDR Howard Bruenn's story, while less action-packed, is still as riveting. Bruenn was President Roosevelt's cardiologist during the waning year of the war. Bruenn's mission was straightforward—keep the President alive as long as possible.

Roosevelt became Bruenn's patient after the cardiologist was called in to consult on the President's condition. After that, Bruenn visited the President four to five times a week, and traveled with him when he went to meet with MacArthur, Nimitz, Churchill, and Stalin. He was with FDR in Warm Springs, GA, at the end.

"I had seen him that morning (April 12, 1945), and he was all right. . . . I went down to the pool . . . and then the Secret Service came down and said that something had happened to the President," said Bruenn.

The book also contains the recollections of one of the Navy's first flight nurses, ENS Kathryn Van Wagner, who joined the Navy at 23 in 1944. Van Wagner and 11 others went to Alameda, CA, to train, but, according to Van Wagner, the Navy was unsure what exactly to teach them. Still, upon graduation, they were sent to the Pacific front and became the first women to help evacuate wounded by air from an active battlefield.

Van Wagner remembers one flight in particular. Despite her best efforts, 3 of her 24 charges died while in the air on the way to the hospital. Not wanting to distress her living patients, she pretended the three were living until they were offloaded at an intermediary stop. No ambulance to take them away or chaplain present, she got off the plane with the bodies and baptized them with grapefruit juice as they lay in the shade of the wing.

"Even though I wasn't particularly religious, it was something I had to do," she recalled.

In the book, LT(jg) Henry Heimlich, then stationed in China, describes how a failed chest surgery performed on a wounded Chinese soldier was the first step to developing the lifesaving maneuver that made his name a household word throughout the world.

Most veterans in Herman's book said they had rarely spoken about World War II since they returned; more than one confided that his interview with the author was the first time in 50 years they had talked of their experiences at all. Why remain silent for all that time?

"When we got back from the war we tried to pick up where we left off. We married, raised families, threw ourselves into our work, and never found the time to contemplate what we'd been through. Now we're retired, the kids are gone, and we have plenty of time on our hands to think about what it all means," said one.

And now that the book is complete, what next? Herman and the Navy Medical Department are producing a seven-part documentary film about World War II based on these and other interviews.

—LCDR Jan Davis, USNR, NR BUMED 106, Washington, DC.

Battle Station Sick Bay: Navy Medicine in World War II is available through the Naval Institute Press, 118 Maryland Avenue, Annapolis, MD 21402-5035, 1-800-233-8764, Web address: http://www.usni.org

Navy Medicine 1950

BUMED Archives

Navy hospital corpsmen George Williams and J.C. Brown mix distilled water with blood plasma for wounded Marine somewhere in Korea.

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